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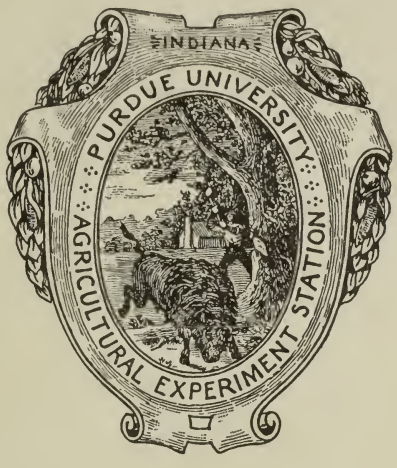
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Alfalfa in Indiana

I. Results of Experiments in Late Summer Seeding.
II. Suggestions for Beginners in Alfalfa Culture.

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Alfalfa in Indiana

By A. T. Wiancko, Agriculturist

I. EXPERIMENTS IN LATE SUMMER SEEDING.

The increasing interest in alfalfa culture among Indiana farmers and the many failures in attempts to establish the crop have brought a constant stream of inquiries to the Station concerning time and methods of seeding. The common practice was to sow the alfalfa in the spring of the year, either with or without a nurse crop of oats or barley, and it was observed that the majority of the failures were due more or less directly to the presence of large numbers of spring and summer weeds, which gradually crowded and choked the alfalfa plants to such an extent that they dwindled away to nothing as the summer advanced. It also appeared that in many cases the nurse crop was of doubtful value as a protection against weeds, and that it often did positive harm by shading the young alfalfa too much. It seemed therefore, that the question to be answered was how to avoid both weeds and nurse crop.

The most practical solution of the problem seemed to lie in first destroying the weed seeds in the soil and then sowing the alfalfa alone. This involved late seeding in order to give time to get rid of the weeds, which could be practically done only by plowing the ground early and harrowing it every ten days or two weeks for a period of several weeks, until all the weed seeds in the surface soil were sprouted and destroyed. By this method the ground might be expected to be in good condition for seeding by the early part of June, and since it is not usually advisable to take a hay crop or pasture the field the first season, there appeared to be no serious objection to even later seeding so long as sufficient growth to thoroughly establish the plants could be secured before winter.

While this method was generally conceded to be safe and practical, two objections were urged against it, namely; the extra labor of preparing the ground for sowing and the sacrifice of a year's crop from the land. To avoid these objections, late summer seeding, after a small grain or other early harvested crop had been removed, was suggested. To determine the value of this suggestion an experiment was undertaken on the University Farm in the summer of 1905. Ground was prepared in early August and seeded to alfalfa on the 17th day of the month. This seeding was in every way satisfactory. A good stand of plants

was secured and the fall growth was sufficient to thoroughly establish the plants and they passed through the winter in good condition. It was observed, too, that weeds were not nearly so troublesome as with spring seeding on the same ground. A seeding made at the same time by Mr. Ellis House at Bicknell, Indiana, was also highly satisfactory.

After these encouraging results, it was determined in the summer of 1906 to further test the practicability of such late seeding by similar experiments in various parts of the state. A letter stating the problem and outlining the plan of the experiments was sent to about seventy-five farmers with a request for their co-operation. Arrangements for sixty-one experiments were completed about the middle of July. Five pounds of alfalfa seed to be sown on a quarter acre plot was sent to each experimenter with the understanding that he would sow it according to instructions and report the condition of the plot before winter and again in April. The instructions for soil preparation and seeding were in part as follows:

"Any well drained piece of fallow or stubble ground will do for the experiment. Prepare the ground as you would for a good corn crop and do it as soon as possible. If the ground is at all hard or inclined to break up cloddy, double disk it once or twice before plowing, and again right after. Go over the plat with a harrow at intervals often enough to keep a loose mulch on top to preserve moisture for seeding. It will be necessary to be very careful in preparing the ground at this season of the year in order to get a sufficiently moist seed-bed. Sow all the alfalfa seed we shall send you on a quarter acre plat, as soon after the first of August as the moisture conditions will permit. In northern sections the seeding should in no case be delayed later than August 10, and in southern sections not later than August 25. Cover the seed with a smoothing harrow.

The tests reported were conducted on 57 different farms located in 42 different counties.

A report covering a list of questions concerning the soil, time of seeding, stand secured, weather conditions, presence of root nodules, amount of fall growth and general thriftiness of the plat was secured in November, and another report concerning winter-killing and spring condition was secured in the latter part of April. A summary of 57 such reports, covering the principal points of interest, is presented herewith:

Analysis of the Reports.

In studying the reports herein presented, it must be remembered that the experiments covered a period of only one year and that, therefore, too much dependence should not be placed upon them. Both the conditions and the results varied very widely,

and it is not safe to draw hasty conclusions. Both good and poor results were secured under almost every combination of conditions, except where standing water and ice existed; what one experimenter found to be a good thing to do another found to be useless, and all through the series we find many apparent contradictions. Just what it is that makes the difference between success and failure can hardly be determined from these reports, and it is quite evident that we shall have to look further for the real causes that produce failure. Except in the case of drouth, weeds and standing water, it does not matter which one we take of the factors on which reports were received, we find that where one man failed another succeeded. It may be safe, however, to conclude that since so many succeeded, the late summer seeding in itself cannot be held responsible for the failures to any great extent. This is further borne out by the facts that the amount of fall growth made does not appear to bear any relation to the condition of the crop in the spring, and that while much winter-killing occurred in one place there was none in the next, although the two cases appear to be quite similar.

Concerning the time of seeding, the reports show that good results were secured with various dates of seeding all through the month of August. Of three seedings made in early September ,two gave fair results and one poor. Out of 38 plots sown between August 7 and 15, thirty four (90%) gave satisfactory fall growth, and nineteen (56%) of these were in good or fair condition at the end of April this spring. Of the 19 plots sown later than August 15, twelve (63%) gave satisfactory fall growth, and ten (83%) of these were in good or fair condition at the end of April this spring. These data indicate that the date limit for successful seeding has scarcely been reached in these experiments, and it seems fair to conclude that with reasonable soil and weather conditions it would be safe to delay the sowing of alfalfa as late as the middle of August, at least, especially when we remember that in the fall of 1906 the growing period was considerably curtailed by the heavy frosts in the early part of October. Sowing about the middle of August would give from four to six weeks' time during which to prepare the seed-bed in cases where it is desired to sow alfalfa after small grain or other early harvested crops, and ordinarily it will be possible to do it satisfactorily in this time in spite of considerable dry weather which often occurs at this time of the year.

Concerning the weather conditions it may be said that the late summer and fall weather was on the whole a little better than usual as regards moisture supply, but there were some important exceptions, as may be seen in the column of remarks. As regards the length of the fall growing period, the conditions were unfavorable all over the state and growth was checked consid-

Summary of Reports on Fall and Spring Condition

	Name of Experimenter.	Post Office Address	County	Kind of Soil	Kind and nature of subsoil	Depth to Standing Water
1	Anderson, R. E.	Martinsville	Morgan	Sandy loam	Gravel & sand	10 to 15 ft.
2	Bell, F. D.	Decatur	Adams	Sandy clay	Sandy clay	Upland
3	Boals, Bert	Shelbyville	Shelby	Clay	Clay	14 ft.
4	Bordner, W. H.	Bristol	Elkhart	Sandy loam	Sand & gravel	18 to 20 ft.
5	Brewer, A. B.	Fairmount	Grant	Clay and clay loam	Clay	16 ft.
6	Bronnenberg, L. H.	Anderson	Madison	Sandy clay	Clay	20 ft.
7	Brown, R. C.	Star City	Pulaski	Sandy	Sandy	27 ft.
8	Chastain, S.	Campbellsburg	Washington	Clay loam	Clay & gravel	15 to 20 ft.
9	Demaree, F. H.	Waveland	Montgomery	Clay loam	Gravelly clay	12 to 14 ft.
10	Ensminger, J.	Danville	Hendricks	Clay loam	Clay	18 ft.
11	Essig, Willie	Tipton	Tipton	Loam	Hard clay	10 ft.
12	Everhart, W. E.	Austin	Scott	Clay loam	Clay	6 ft.
13	Fisher, C. F.	Lafayette	Tippecanoe	Clay and loam	Clay	15 ft.
14	*Grimes, G. T.	Pettysville	Miami	Sand and clay loam	Clay	Upland.
15	*Harper, J. W.	LaFontaine	Wabash	Black sandy loam	Gravelly	15 ft.
16	Harrod, C. A.	Austin	Scott	Clay	Gravelly clay	10 ft.
17	Helms, J. S.	Richmond	Wayne	Clay	Clay	20 to 25 ft.
18	Heilman, R. L.	Hope	Bartholomew	Black loam	Clay loam	4 ft.
19	Hiett, F. W.	Guilford	Dearborn	Black loam		Upland
20	Hill, E. W.	Winchester	Randolph	Clay and black loam	Clay	4 to 8 ft.
21	Hornaday, Wm.	New Augusta	Marion	Clay and loam	Clay	3 ft.
22	Huffman, J. J.	Nappanee	Elkhart	Clay and loam	Clay	2 ft.
23	Hughel, H.	Anderson	Madison	Sandy loam	Clay	4 to 5 ft.
24	Kinney, Otis	Spencer	Owen	Sandy clay	Clay	5 ft.
25	Kirby, Ben	Bloomington	Monroe	Loam	Clay	75 ft.
26	Lamb, B. A.	Petersburg	Pike	Sandy loam	Clay hardpan	90 ft.
27	Landrey, J.	Yorktown	Delaware	Clay loam	Hard clay	14 ft.
28	Ludwick, P. F.	Winchester	Randolph	Black loam	Clay	21 ft.
29	Matthews, Mrs. C.	Clinton	Vermillion	Sandy loam	Clay	3 ft.

of Alfalfa Sown in Late Summer, 1906.

evious Crop	Date of Sowing Alfalfa	Stand Secured	Amount of fall growth	Amount of winter killing	Late Spring Stand	Presence of root nodules	REMARKS.	
owing rn	Aug. 10	Good	Little				Sowed in standing corn. Total failure in fall due to dry weather and shading of corn.	1
ass	Aug 11	Good	8 in.	Considerable	Medium	Some	Pastured in late fall. Water and ice damaged the stand.	2
heat	Aug. 13	Good	8 in.	70%	Poor	Some	Mostly killed by wet weather in early winter.	3
raw-rries	Aug. 9	Good	6 to 10 in.	None	Good	A few	Inoculated part of plot but could see no difference. Grew 3 inches in March.	4
eadow	Aug. 11	Good	8 to 10 in.	75%	Medium	None	Closely pastured in fall.	5
ats	Aug. 9	Medium	6 in.	75%	Very poor	None	Weather too dry in early fall. Young alfalfa should get light mulch of manure or straw in fall	6
tatoes	Aug. 13	Good	6 in.	15%	Fair	None		7
rn	Aug. 20	Good	6 to 8 in.	Little	Fair	Some	Sowed in standing corn. Intend to sow more. Chickens very fond of alfalfa.	8
heat	Aug. 10	Good	12 in.	40%	Poor	None	Fall weather was dry and hot.	9
ats	Aug. 11	Good	10 in.	25%	Medium	None	Partly destroyed by standing water.	10
ne	Aug. 23	Poor	Little				Sowed on fallow ground. Seeds sprouted but perished on account of very dry weather.	11
rn	Aug. 16	Poor	None				Total failure in fall. The season was the driest on record.	12
ats	Aug. 25	Medium	2 in.	100%	None		Roots torn out by heaving.	13
heat	Aug. 14	Good	4 in.	5%	Good	None	Sowed 7 acres. Pleased with prospect.	14
mothy	Aug. 14	Good	9 in.	25%	Good	Some	Stand plenty thick yet. Sowed 3 acres, sorry it wasn't 10.	15
sture	Aug. 10	Good	8 in.	Little	Good	Some	An acre of spring sown alfalfa beside this plot was badly froezn out.	16
uck	Aug. 22	Good	8 in.	25%	Fair	Considerable	Sowed 4 acres Aug. 25 and got good stand. Inoculated seed with bacteria.	17
ats	Aug. 10	Good	8 in.	75%	Poor	None	Flood water and ice damaged plot in winter, then heaving in spring.	18
heat	Aug. 9	Good	12 in.	30%	Fair	Some	Plot looked fine in early spring about 9 inches high before April frosts, which hurt stand.	19
ats	Aug. 15	Fair	8 in.	None	Fair	None	Seed was not sown thick enough for a good stand. Growth satisfactory.	20
eadow	Aug. 14	Poor	5 in.	Some	Poor	Few	Very dry fall weather caused poor stand. Considerable spring heaving.	21
heat	Aug. 10	Good	3 to 4 in	30%	Medium	None	Some of the damage to the stand was done by standing water.	22
heat	Aug. 9	Good	15 in.	30%	Medium	Some	Clipped twice in September and still got growth of 8 to 10 inches before winter.	23
ats	Aug. 9	Good	6 in.	50%	Poor	None	Badly frozen in April. Think it may recover.	24
ats	Aug. 28	Good	3 in.	None	Fair	Some	April frosts did some harm.	25
e	Aug. 29	Good		None	Good	None	Clipped once in fall on account of weeds. Got 6 inches of later growth.	26
tatoes	Aug. 13	Good	5 in.	75%	Poor	None	Stand much hurt by heaving.	27
	Aug. 11	Good	8 to 10 in.			Some		28
llow	Aug. 15	Good	12 in.	None	Extra good	Considerable	Alfalfa sown on same ground in spring failed.	29

Summary of Reports on Fall and Spring Condition of

	Name of Experimenter	Post Office Address	County	Kind of Soil	Kind and nature of subsoil	Depth to Standing Water
30	McBride, C. E.	Anderson	Madison	Black sandy loam	Clay	15 ft.
31	McClain, Henry	Bellmore	Parke	Clay	Clay	Upland
32	McClure, H. B.	Oxford, Ohio	Franklin	Clay loam	Gravelly clay	10 ft.
33	McMahan, C. S.	Liberty	Union	Clay loam	Very hard clay	15 ft.
34	McMahan, J. N.	Liberty	Union	Clay	Clay	Upland
35	McQuiston, S.	Greentown	Howard	Loam		22 ft.
36	Mertz, O. E.	Corunna	DeKalb	Sandy loam	Gravel & sand	7 to 8 ft.
37	Mishler, Lewis	Collamar	Whitley	Sandy loam	Gravelly clay	12 to 20 ft
38	Moore, C. W.	Yeoman	Carroll	Clay	Gravelly clay	6 ft.
39	Murphy, J. T.	Shelbyville	Shelby	Gravelly loam	Clay	10 ft.
40	Nottingham, C. A.	Muncie	Delaware	Clay	Sandy clay	33 ft.
41	O'Neall, M. G.	Washington	Daviess	Clay	Clay	Upland
42	Peek, R. M.	Shoals	Martin	Sandy	Clay	30 ft.
43	Perry, J. F.	LaOtto	Noble	Clay and loam	Clay	Upland
44	Prigg, J. P.	Daleville	Delaware	Black loam and clay	Clay	4 ft.
45	Sallee, O. M.	Salem	Washington	Clay loam	Clay	30 ft.
46	Sanford, W. J.	Lebanon	Boone	Clay	Clay	15 ft.
47	Scott, J. G.	Borden	Clark	Loam	Clay	Upland
48	Seirgart, C. M. C.	Logansport	Cass	Sandy loam	Gravelly	6 to 10 ft.
49	Squires, D. C.	Orland	Steuben	Clay loam	Clay	60 ft.
50	*Stembel, W.	Oxford	Benton	Black sandy loam	Clay	Upland
51	Sterrett, C. T.	Terr Haute	Vigo	Clay	Clay	12 ft.
52	Swaim, O. R.	Marshall	Parke	Clay	Clay	16 ft.
53	Vestal, C. P.	Montezuma	Parke	Loam	Gravelly	35 ft.
54	Whisler, G. T.	Chalmers	White	Black sandy loam	Hard clay	3 ft.
55	Woods, W. J.	Kramer	Warren	Clay	Gravelly clay	Upland
56	Yoke, T. E.	Acton	Johnson	Black loam and clay	Clay	12 ft.
57	Zook, F. W.	Denver	Miami	Clay	Clay	50 ft.

*Not in the regular experiment.

Alfalfa Sown in Late Summer, 1906—Concluded.

Previous Crop	Date of Sowing Alfalfa	Stand Secured	Amount of fall growth	Amount of winter killing	Late Spring Stand	Presence of root nodules	REMARKS.	
Clover	Sept. 1	Fair	3 in.	75%	Poor	Some		30
Oats	Aug. 11	Good	8 in.	Some	Poor	None	Most damage to stand done by April frosts and late heaving.	31
Oats	Aug. 11	Good	6 to 12 in.	85%	Poor	Few	More damage done by freezing than by heaving.	32
Meadow	Aug. 15	Good	8 to 10 in.	5%	Good	Some	Inoculation with pure cultures and with soil showed no effect.	33
Wheat	Aug. 15	Good	6 in.	None	Good	Few	Fall weather a little dry. Found drilling better than broadcasting. Inoculation with soil showed no effect.	34
Clover	Sept. 10	Medium	3 in.	10%	Medium	Some	Fall weather very dry. Well pleased with the experiment.	35
Potatoes	Aug. 14	Good	8 in.	60%	Poor	Plenty	Most damage to stand done by April frosts.	36
Alfalfa	Aug. 20	Good	7 in.	None	Good	Some	Fall weather rather dry.	37
Potatoes	Aug. 14	Good	8 in.	10%	Fair	Some	Fall weather very dry at first. Hurt by April frosts.	38
Wheat	Aug. 11	Good	8 in.	10%	Good	Some	Several neighbors got good fall stands.	39
Rape	Aug. 11	Medium	8 in.	100%	None	None	Part heaved out, part killed by late frosts.	40
Oats	Sept. 5	Good	4 in.	20%	Fair	None	Damage to stand done by late frosts. Inoculated seed with bacteria cultures.	41
Meadow	Aug. 21	Good	12 in.	None	Medium	Some	Stand was reduced to minimum during fall. Weather rather dry. Some weeds.	42
Potatoes	Aug. 13	Good	6 in.	75%	Poor	Some	Rather dry fall weather. Winter and spring weather very severe.	43
Oats	Aug. 23	Good	10 in.	25%	Poor	Some	Alfalfa looked well at beginning of April.	44
Wheat	Aug. 15	Good	9 in.	10%	Medium	None	Late fall too dry. Some weeds. Damage to stand done by late frosts.	45
Grass	Aug. 21	Medium	4 in.	75%	Poor	None	Fall weather too dry. Plot damaged by chickens in fall.	46
Truck	Aug. 28	Good	12 to 14 in.	Slight	Good	Plenty	Fall weather rather dry. April frosts did some harm.	47
Potatoes and corn	Aug. 20	Good	6 to 8 in.	Slight	Good	Plenty	Have 16 acres of alfalfa. The greatest plant on earth.	48
Wheat	Aug. 15	Good	5 in.	Slight	Poor	Some	Severe storm killed many young plants in early fall. Part of plot in good condition.	49
Oats	Aug. 15	Good	3 in.	75%	Poor	None	Fall weather a little dry at first.	50
Potatoes	Aug. 30	Good	2 to 3 in.	None	Fair	Some	Some damage done by late spring frosts.	51
Clover	Aug. 7	Good	Large	30%	Medium	None	Clipped Sept. 19. Later growth 8 inches. Some weeds.	52
Wheat	Aug. 8	Fair	8 in.	25%	Medium	None	Dry weather and weeds reduced stand in fall.	53
Oats	Aug. 25	Poor	2 in.	100%	None		Condition of fall weather was against making a fair test.	54
Oats	Aug. 14	Good	3 to 12 in.	50%	Poor	Plenty	Fall weather too dry. Sowed 8 acres. Think it would have been all right in an ordinary year.	55
Timothy	Aug. 17	Good					The young plants were eaten up by grasshoppers.	56
Truck	Aug. 8	Medium	6 in.	Slight	Medium	None	Planning to sow 10 acres more.	57

erably earlier than usual on account of the severe frosts in the early part of October. The winter and early spring were unusually severe, and judging from the effect on clover, caused considerably more damage than would have been the case under ordinary conditions.

Of the fifty-seven reports received, thirty (53%) state that the fall weather was, on the whole, favorable. In the other cases (47%) the fall weather was more or less unfavorable at one time or another. Of the forty-four (77%) who report good stands, sixteen (36%) say the fall weather was rather too dry, and in five cases very dry. Of the nine (16%) who report medium stands, four (44%) say the weather was too dry, two had good weather, two do not state, and the other sowed the alfalfa too thin. The four (7%) who report poor stands also report very dry weather. One of these also reports sowing in standing corn.

Of the thirteen who report deterioration in the stand during the fall, six attribute it to dry weather, two to weeds and dry weather combined, one to sowing in corn, one to grasshoppers, one to a severe storm and two give no particular reason for deterioration.

While dry weather is held responsible for the majority of the failures to get a good stand or satisfactory fall growth, it appears that in a number of cases good results were secured under very dry weather conditions.

Concerning winter-killing, the reports do not show any relation between the date of seeding and the amount of winter-killing. There was fully as much winter-killing among the plots sown in the early part of August as among those sown around the 1st of September. The proportion of winter-killing, however, was alarmingly large and it appears that the winter and early spring weather are very important factors. It must be remembered in this connection that the past season was very unusually severe and that ordinarily very much less damage might be expected.

Out of fifty-two experimenters who reported on the spring condition, twenty-three (44%) reported less than ten per cent. of damage by winter-killing; eleven (21%) reported from ten to thirty per cent. of damage, in two of which cases the damage was largely due to standing water; and eighteen (35%) reported over thirty per cent. of damage, in two of which cases the damage was largely due to standing water and ice. Out of 38 plots on clay and clay loam soils reported in spring, eleven (29%) showed no appreciable winter-killing, twenty-four (63%) showed less than thirty per cent., and fourteen (34%) showed over thirty per cent. of winter-killing. Of 14 plots on sandy and sandy or gravelly loam soils reported in spring, six (43%) showed no appreciable winter-killing, ten (71%) showed less than thirty per cent., and

four (29%) showed over thirty per cent. of winter-killing. It will be seen from this that while there was more or less winter-killing on all types of soils, there was relatively less on the lighter soil. The difference, however, is not very great, and some of the heaviest clay soils gave quite satisfactory results.

Concerning the effect of type of soil on the initial stand secured, the reports show that 13 pure clays all gave good or fair stands, 38 clay and clay loam soils gave twenty-eight (74%) good or fair stands, and 15 sandy or sandy loam soils gave fourteen (93%) good or fair stands.

The preceding crop had no appreciable effect upon the results secured, except in the case of standing corn. In 3 cases of sowing in standing corn, one gave a good stand, but it dwindled away and the failure was attributed to dry weather and excessive shading by the corn; one gave satisfactory results, and the other gave a poor stand and that dwindled away on account of dry weather.

Concerning the effect of special fertilization, the reports show that in 12 cases where manure was used, five were in good condition in spring, six fair, and one was in poor condition. One plot where commercial fertilizer alone was used was in good condition in spring. In 39 cases where no special fertilization was given, six were in good condition in spring, thirteen fair, and eighteen were in poor condition. This shows that special fertilization may be of considerable value in securing satisfactory results.

Concerning trouble with weeds the reports show that out of the 56 who reported, forty (71%) had no trobule with weeds, fifteen (27%) reported a little trouble, and one reported considerable damage to stand from weeds.

Out of fifty-one who answered the question concerning the presence of root nodules, twenty-one (41%) reported that none could be found, twenty-four (47%) reported some, and six (12%) reported nodules present in considerable numbers. Special inoculation was tried by four of the experimenters. In one case there were no nodules found. In two cases nodules were found on both inoculated and uninoculated areas. In the fourth case all the seed was inoculated and plenty of nodules were found. These observations indicate that some special form of inoculation is probably necessary in practically one-half of the cases where alfalfa is first introduced.

The experiments of the Station will be continued this year, with some additions and variations. Full particulars concerning co-operative experiments will be furnished upon application.

II. SUGGESTIONS FOR BEGINNERS IN ALFALFA CULTURE.

The results of our experiments in alfalfa culture up to the present time do not warrant us in making many very definite statements concerning the conditions necessary and the best methods of procedure in order to establish a satisfactory field of alfalfa. Of a few things, however, we are absolutely sure. One of these is that the land for alfalfa must be thoroughly drained, either naturally or artificially, and that all lands which are subject to overflow, or are liable to have standing water of any kind upon them at any time, are absolutely unfit for alfalfa. It has been demonstrated time and again that alfalfa cannot exist in the presence of standing water on or near the surface of the ground. The usual water level in the soil should not be higher than four feet below the surface, and on the heavier types of soils good drainage must be provided for all surplus rain water.

Soil and Fertilization.

There is a great deal of substantial evidence that goes to show that almost any type of soil, from heavy clays to sandy and gravelly loams, will give satisfactory results with alfalfa if the drainage is good and the soil is otherwise in good crop producing condition.

Many people make the fatal mistake of expecting alfalfa to do well on soils that are not fit to properly produce any kind of a crop. Due consideration must be given to the fact that alfalfa requires large amounts of plant food. After it is thoroughly established and properly inoculated with its nitrogen gathering bacteria, alfalfa will supply itself with nitrogen from the air, but all mineral food elements must come from the soil, and as the crop is naturally a large producer, large quantities are required. Only soils that are in good crop producing condition should be used for alfalfa.

Wherever some special fertilization is desired to hasten development, stable manure is one of the best things that can be used. Numerous experiments and the experience of many farmers have shown that stable manure not only helps to insure a good stand and strong growth, but that it also greatly facilitates the inoculating process, and often special inoculation is not necessary where manure is used. From five to ten tons per acre should be applied, according to the quantity available and the probable needs of the soil. Concerning methods of applying manure, the bulk of the evidence is in favor of plowing it under, although well rotted manure may be advantageously disked into the surface. When sufficient manure is not to be had and a commercial fertilizer is to be used, a mixture containing 1 to 2 per cent. of nitrogen, 6 to 8 per cent. of phosphoric acid, and 6 to 8

per cent. of potash, applied at the rate of three or four hundred pounds per acre, will probably give the best results.

Concerning the use of lime for alfalfa on Indiana soils, we have not yet secured sufficient data to warrant us in making any definite recommendations. In the experiments with alfalfa on the University Farm lime has been applied at different times without any apparent effect. In other sections of the state, we have been able to learn of but few cases where lime has been used for alfalfa, and in none of these has it shown any important effect.

The most satisfactory way to test the need of a soil for lime is to make a small trial application in a representative portion of the field under suspicion and watch the results. Applications of lime should generally be made several months before the seed is sown. A good practice for spring seeding is to plow the lime under the fall before. With our present knowledge we would recommend the use of about a ton per acre of air slaked lime. Cheap lime for this purpose can be secured from almost any lime kiln, as there is always more or less waste in the form of screenings that cannot be sold as quicklime. Some kiln operators will furnish this waste lime for the cost of loading it. For use on the soil this material is as valuable as anything that can be secured, and when compared with ground limestone it is worth practically twice as much, since it furnishes practically double the amount of actual lime.

Soil Preparation and Seeding.

Alfalfa cannot be successfully established on ground that is infested with weed seeds. This is another of the things of which we are absolutely sure. Young alfalfa is very sensitive to the presence of weeds, and there are very few cases where it will not be crowded down and out sooner or later if weeds are permitted to grow, and they surely will grow if there are any live seeds near the surface of the ground. Trouble with weeds, especially in spring seeding, has been the most potent cause of failure to secure satisfactory results with alfalfa in Indiana. Few people realize how full of weed seeds the ground really is, even where careful cultivation has been the rule. A corn field, for example, may be perfectly free of weeds in the fall after a season of careful cultivation, but next spring, when the ground is either plowed or deeply stirred up to properly prepare it for the next crop, a fresh lot of weed seeds is brought near the surface. With most crops these might not be particularly noticed, but if alfalfa is sown they are bound to get in its way. The common Foxtail is by far the most troublesome weed that we have to deal with in this connection. A number of other grasslike weeds, such as "crab grass" and "tickle grass," are also frequently heard of as

troublesome to young alfalfa. There is only one way to escape from trouble of this kind, and that is by destroying the weeds before sowing the alfalfa. This may be done at any time during the spring or summer by harrowing the ground every week or ten days for a period of a month or six weeks after it has been plowed and otherwise fully prepared for the alfalfa. A longer period of time is necessary for this weed killing process in the spring than later in the season, because germination is slower in the colder soil, and the weed seeds must be thoroughly sprouted before harrowing will destroy them.

A few years ago most of our people who pretended to know anything about alfalfa seeding, recommended the use of a nurse crop to keep down weeds, but many recent experiences have shown that the nurse crop idea is wrong. The nurse crop is more or less of a weed in itself, and both weeds and nurse crop must be avoided by a period of clean culture before sowing the alfalfa.

At present we feel safest in recommending that soil preparation for alfalfa seeding be begun in the spring of the year rather than in midsummer, because of the greater certainty of securing the right kind of a seed-bed at that time. If the soil is one of the heavier types, it should be double disked (lapping one-half) before plowing. If the ground has been fall plowed it may be prepared in spring by thorough disking. After thorough preparation, however accomplished, the seed-bed must be harrowed at least three or four times at intervals of about ten days, to sprout and kill weed seeds, until some time in June or July, according to the character of the season. The alfalfa seed should then be sown alone at the rate of twenty pounds per acre. It may be broadcasted and lightly covered with a smoothing harrow, or it may be drilled with a wheat drill, if the drill is of a kind that can be adjusted to sow the desired amount of seed and set to cover the seed at a reasonable depth. In a loose soil and a dry season the seed may be covered deeper than in a heavy soil and a wet season. Ordinarily covering an inch deep will be satisfactory.

While the method described above gives the greatest assurance of success, the experiments herein reported, and a few experiments and observations in previous years, indicate that it is possible to get a satisfactory stand of alfalfa on ground that is not prepared for sowing until after wheat, clover or other early harvested crop has been removed from the ground, especially with favorable summer and fall weather. The greatest objection to this practice lies in the fact that there may not be sufficient moisture to properly prepare the ground and get a sufficient fall growth to thoroughly establish the plants. It seems, however, that wherever it is important to avoid the loss of a year's crop, and where the soil is in good con-

dition, this method may be employed with reasonable chances of success. One point must always be kept in mind, no matter which method is employed, and that is that sufficient time and labor must be given to soil preparation to rid the surface of all weed seeds.

In counting the cost of establishing an alfalfa field, we should always take into account the fact that this one soil preparation and seeding, if properly accomplished, will be good for many years. If the soil is in poor condition and the stand imperfect, there will be just so much of a loss every year that the crop occupies the ground. Alfalfa should always be put in a place where it can be left for at least five or six years. It does not attain its best development until about three years old, and it may be kept in good condition almost indefinitely.

Inoculation.

Concerning soil inoculation for alfalfa, we can only say at the present time that it seems to be necessary in about half of the cases where the crop is first introduced. It is quite probable that the spread of alfalfa culture in the state is already having some effect in lessening the need of artificial inoculation. The experiments reported in this bulletin show that in many cases nodules developed without special inoculation, and many similar cases have come to our notice in the last two years. It has often been observed that where manure is applied the need of especial inoculation may be avoided. The so-called pure cultures of bacteria for inoculation have not produced noticeable results in a single instance where we have tried them.

Wherever inoculation is considered necessary, we would advise the use of soil from a good alfalfa field where the bacteria are known to exist. At least one or two hundred pounds of clean soil should be used per acre, and if at all possible it should be incorporated with the seed.

The Experiment Station has neither soil nor other inoculating material for sale.

Clipping.

The information we have concerning the clipping of alfalfa during the first season is too contradictory to permit of making any general rule. It seems, however, that clipping has sometimes been overdone and that young alfalfa should rather be allowed to grow undisturbed so long as it is doing well and does not bloom. With early seeding, one clipping in the latter part of August will generally be advisable. Otherwise clipping should only be practiced when the growth seems checked, or the tops of the plants turn yellow. If not too heavy the cut material should

be left on the ground to act as a mulch. All growth after the middle of September should be allowed to die down naturally for protection to the roots over winter.

Cutting for Hay.

When alfalfa is used for hay-making it should be mowed whenever about one tenth of it has come into bloom, regardless of size. In ordinary seasons this will be about the end of May, the first of July and the early part of August, and a good field will often yield four cuttings.

The general treatment in curing the hay is the same as that for clover, but great care must be exercised in handling it to avoid breaking off and losing the leaves, which dry quickly and are then very brittle.

Pasturing.

Alfalfa should never be pastured the first season, and in many cases it will be best to use it for mowing during the second season, in order that it may become thoroughly established before animals are allowed to tramp over it. It should never be pastured closely, as close pasturing injures the crowns of the plants. Horses and sheep are more likely to do damage in this way than are cattle or hogs. Alfalfa makes excellent pasture for all kinds of live stock, and it is especially desirable for hogs during hot weather. With cattle and sheep care must be exercised to avoid bloating. At first the animals should be turned in for only a short time each day until they become accustomed to it, and when the alfalfa is wet, as after a rain, there is still greater need of care. It is wise to be a little more careful than with clover.

Additional Notes.

Alfalfa is used to feed all kinds of farm live stock, from chickens to horses.

It will yield from 3 to 6 tons of excellent hay per acre per season, according to the fertility of the soil.

It is rich in flesh forming nutrients and is excellent for feeding with corn or other starchy foods.

It is more digestible than red clover and is not far behind wheat bran in feeding value.

It is an excellent soil renovator, gathering nitrogen from the air, opening up the soil and bringing large quantities of mineral food from the subsoil.

The little information that we have upon the subject indicates that alfalfa should not be used as a seed crop in Indiana, except perhaps in the last season before plowing it up. Seed production weakens the plants and reduces the stand, and the seed crop produced will seldom be a profitable one.

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